

CHAPTER 4

DESIGN DOCUMENTATION

4.1 Overview

4.1.1 Introduction

An important part of the design or analysis of any hydraulic facility is the documentation. Appropriate documentation is essential because of:

- the importance of public safety
- future reference by engineers (when improvements, changes, or rehabilitations are made to the drainage facilities)
- information leading to the development of defense in matters of litigation
- public information

Frequently, it is necessary to refer to plans, specifications and analysis long after the actual construction has been completed. Documentation permits evaluation of the performance as anticipated or to establish the cause of unexpected behavior, if such is the case. In the event of a failure, it is essential that contributing factors be identified in order that recurring damage can be avoided.

4.1.2 Definition

The definition of hydrologic and hydraulic documentation as used in this chapter is the compilation and preservation of the design and related details as well as all pertinent information on which the design and decisions were based. This includes maps, field survey information, source references, photographs, engineering calculations and analyses, measured and other data, and flood history including narratives from newspapers and individuals such as highway maintenance personnel and local residents who witnessed or had knowledge of an unusual event.

4.2 Purpose

The purpose of this chapter is to present the documentation that will be included in the design files and on the construction plans. This chapter focuses on the documentation of the findings obtained in using the other chapters of this manual, and thus engineers should be familiar with the hydrologic and hydraulic design procedures associated with this manual. This chapter identifies LFUCG's system for organizing the documentation of hydraulic designs and reviews so as to provide as complete a history of the design process as is practical.

The major purpose of providing good documentation is to define the design procedure that was used and decisions that were made to arrive at the final design. Documentation should be viewed as the record of reasonable and prudent design analysis based on the best available technology. Thus, good documentation can provide the following:

- identification of the situation at the time of design which might be very important if legal action occurs in the future
- protection for the engineer by proving that reasonable and prudent actions were, in fact, taken (such proof should certainly not increase a potential court award and may decrease it by disproving claims of negligence by the plaintiff)
- documentation that generally accepted procedures and analysis were used at the time of the design which were commensurate with the perceived site complexity and flood hazard (this should further disprove negligence claims)
- a continuous site history to facilitate future reconstruction
- the file data necessary to quickly evaluate future site problems that might occur during the facility's service life
- expedited plan development by clearly providing the reasons and rationale for specific design decisions

4.3 Improvement Plans

4.3.1 50 Percent Design

The following information shall be submitted on a 2' contour map at a scale of 1"=50'. The drawing size shall be 24" x 36".

- a map showing all drainage areas and subareas used to size hydraulic structures
- proposed inlet, storm sewer, culvert, and manhole system and their sizing calculations
- proposed stormwater best management practices
- proposed constructed channels and their sizing calculations
- 10-year and 100-year post development floodplains
- FEMA floodplain
- sinkholes
- caves
- springs
- ponds
- streams
- wetlands
- tree stands
- steep slopes greater than 15%
- greenways shown in the Greenway Master Plan
- existing and proposed underground utilities
- the sinkhole surface drainage analysis as described in the Subdivision Regulations

4.3.2 Final Design

Final design drawings shall be 24 x 36" in size. Plan view drawings shall be at a scale of 1"=50' with 2' contours. Profile sheets shall be at a scale of 1"=50' horizontal and 1"=5' vertical.

Hydrology

Submit the following items:

- watershed area size
- peak discharge and hydrographs for design storms
- expected level of development in upstream watershed over the anticipated life of the facility (include sources of basis for these development projections)

Inlets, Storm Sewers, and Manholes

Submit the following items:

- computations for inlets and pipes, including hydraulic grade lines
- complete drainage area map
- a schematic indicating storm drain system layout

- pipe lengths, slopes, diameters, and material
- structure types, labels
- grate elevations
- existing and proposed 2' contours
- separate sheets for details

Plan View:

- street layout, lot lines
- catch basins: type, designation (station and number), invert elevation, and station offset
- pipes: sizes, type, class, slope, and designation
- manholes: size and type, station and offset
- headwalls: type and invert elevation
- sanitary sewer crossings
- culvert size and shape
- other utility line crossings

Profile View:

- underground utility crossings
- existing and proposed ground surfaces
- curb inlets: elevations and type
- manholes: elevations and type
- pipes with size, grade, type, class, length
- headwall type and elevation
- all crossings (with elevations) of sanitary sewers and underground utilities
- all street sections at crossings and all regrade contours
- capacity and proposed flows in pipes
- hydraulic grade lines
- manholes
- inlet and outlet elevations of pipes
- copies of all computer analyses, with input data listed and output clearly identified

Culverts and Bridges

Submit the following items:

- culvert performance curves
- allowable headwater elevation and basis for its selection
- cross-section(s) used in the design highwater determinations
- roughness coefficient assignments (n values)
- observed highwater, dates, and discharges
- stage discharge curves
- performance curves showing the calculated backwater elevations and outlet velocities for the design storms
- type of culvert entrance condition

- culvert outlet appurtenances and energy dissipation calculations and designs
- copies of all computer analyses, with input data listed and output clearly identified
- roadway geometry (plan and profile)

Constructed Channels

Submit the following items:

- profiles
- cross-section(s) used in the design water surface determinations and their locations
- roughness coefficient assignments (n values)
- channel velocities
- water surface profiles through the reach for the design 100-year storm
- design analysis of materials proposed for the channel bed and banks
- energy dissipation calculations and designs
- copies of all computer analyses, with input data listed and output clearly identified

Stormwater Best Management Practices

Submit the following items:

- design calculations and schematics
- complete drainage area map, delineating area draining to each practice and denoting total area and impervious area draining to each device
- separate detail sheet for detention/retention basins
- detail sheets for water quality treatment devices
- water quality treatment practice (designate type of device, total area and impervious area draining to device, and volume used to size device)
- embankment cross section
- top of embankment elevation
- peak stages
- emergency spillway details
- principal spillway details
- 1'-contour plan view of detention volume
- other utilities

Erosion and Sediment Control Plan

Submit the Erosion and Sediment Control Plan described in Chapter 11.

4.3.3 Composite Drainage Plan

This plan is intended to aid homebuilders and commercial/industrial builders in preparing their application for a building permit. The following information shall be shown on the Composite Drainage Plan.

- surface drainage easements on each lot

- flow arrows that indicate the direction of surface drainage through each surface drainage easement
- sanitary sewers and manholes
- storm sewers and manholes
- surface inlets, curb inlets, constructed channels, and stormwater best management practices
- Flood Protection Elevation for
 - Lots adjacent to or containing a post-development floodplain
 - Lots adjacent to or containing a constructed channel
 - Lots at the low point of a street
 - Lots adjacent to a detention/retention pond
- Environmentally sensitive areas
- Non-buildable areas such as sinkholes, floodplains, vegetation buffer strips, and wetlands
- Alluvial soils

4.4 Record Drawings

A record drawing of all stormwater structures shall be submitted at the end of construction. Plan view drawings shall be at a scale of 1"=50' with 2' contours. Profile sheets shall be at a scale of 1"=50' horizontal and 1"=5' vertical. Drawings shall be 24" x 36" in size.